FPL

L-2013-138
10 CFR § 50.73
APR 19 2013

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D. C. 20555-0001

Re: Turkey Point Unit 3
Docket No. 50-250
Reportable Event: 2013-003-00
Manual Reactor Trip Due to Increasing Reactor Coolant Pump Seal Leakage

The attached Licensee Event Report 05000250/2013-003-00 is submitted in accordance with 10 CFR 50.73(a)(2)(iv)(A) due to valid actuations of the Reactor Protection and Auxiliary Feedwater Systems.

If there are any questions, please call Mr. Robert J. Tomonto at 305-246-7327.

Very truly yours,

Michael Kiley
Vice President
Turkey Point Nuclear Plant

Attachment

cc: Regional Administrator, USNRC, Region II
Senior Resident Inspector, USNRC, Turkey Point Nuclear Plant

IE22
NRR

NRC FORM 366 (10-2010) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 10/31/2013

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA/Privacy Section (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects.resourse@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

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4. TITLE

Manual Reactor Trip Due to Increasing Reactor Coolant Pump Seal Leakage

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
2	18	2013	2013	- 003 -	00	4	19	2013	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE

Mode 1

10. POWER LEVEL

72

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: *(Check all that apply)*

☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☒ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)0	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ OTHER
☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER (Include Area Code)
Paul F. Czaya	305-246-7150

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
B	AB	P	Areva	ICES					

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*

On February 17, 2013, with the Unit 3 reactor in Mode 1 at approximately 99% power, the 3A Reactor Coolant Pump (RCP) No. 1 seal leak-off became elevated and erratic. A unit shutdown was commenced on February 18, 2013 at approximately 0055 when seal leak-off increased to 5.5 gpm. At approximately 0130, the reactor was manually tripped at approximately 72% power when seal leak-off flow reached 6 gpm. The 3A RCP was then secured and No. 1 seal leak-off was isolated. The Auxiliary Feedwater (AFW) System actuated as designed based on low steam generator (SG) levels as a result of the reactor trip. At approximately 0316, AFW was secured with main feedwater supplying the SGs and decay heat removed via the atmospheric relief valves. There were two causes: 1) The seal runner o-ring was damaged during installation. 2) The RCP shaft shoulder critical criterion of 60% minimum mating surface area was not attained after manual machining (stoning). Corrective actions include replacing the 3A RCP seal, review of performance of other RCP seals at both Turkey Point units, and revision of the RCP maintenance procedure to provide additional guidance for proper seal installation and post-machining inspections.

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NARRATIVE

DESCRIPTION OF THE EVENT

On February 17, 2013, with the Unit 3 reactor [AC, RCT] in Mode 1 at approximately 99% power, the 3A Reactor Coolant Pump (RCP) [AB, P] No. 1 seal [AB, P, SEAL] leak-off became elevated and erratic. The alarm for No. 1 seal leak-off high flow is at 5 gpm. RCP shutdown is required when No. 1 seal leak-off is above 5.5 gpm and on February 18, 2013 at approximately 0055 unit shutdown commenced. At approximately 0130, the Unit 3 reactor was manually tripped at approximately 72% power when No. 1 seal leak-off flow reached 6 gpm. The 3A RCP was then secured and No. 1 seal leak-off was isolated in accordance with plant procedure. The Auxiliary Feedwater (AFW) System [BA] actuated as designed based on low steam generator (SG) [SB, SG] levels as a result of the reactor trip. At approximately 0316, AFW was secured with main feedwater [SJ] supplying the SGs and decay heat removed via the atmospheric relief valves [KE, RV].

The NRC Operations Center was notified by Event Notification 48764 at approximately 0319 on February 18, 2013 in accordance with 10 CFR 50.72(b)(2)(iv)(B) and 10 CFR 50.72(b)(3)(iv)(A).

This event is reportable in accordance with 10 CFR 50.73(a)(2)(iv)(A) as "...any event or condition that resulted in manual or automatic actuation of any of the systems listed in paragraph (a)(2)(iv)(B) of this section." The Reactor Protection System [JC] was manually actuated and the AFW System automatically actuated during the event and are included in the systems listed in paragraph (a)(2)(iv)(B).

CAUSE OF THE EVENT

An investigation indicated there were two root causes for this event:

1. As a result of inherent seal design characteristics, the seal runner o-ring was damaged during installation.

2. The RCP shaft shoulder was not verified to ensure that the critical criterion of 60% minimum mating surface area was attained after manual machining (stoning).

ANALYSIS OF EVENT

The 3A RCP No. 1 seal is a Model 93 controlled leakage film-riding face seal. The term controlled leakage is used because leakage from the seal is predetermined and controlled, by ensuring that the gap between the non-rotating part (seal ring) and the rotating part (seal runner) is held to a nearly constant value. This is achieved by designing for a stable balance of hydrostatic forces between the ring and runner seal face plates. The seal was installed during the recent refueling outage that had ended in September 2012.

The seal was disassembled, inspected and found to have a degraded No. 1 seal ring double delta channel seal (DDCS) and a failed No. 1 runner o-ring. The runner o-ring had indications of twisting, rolling, material loss and cuts indicative of erosion. Sections of the runner o-ring were dislodged from its corresponding retaining

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groove. The shaft shoulder for the runner was also found damaged. The runner anti-rotation pin slot in the sleeve and the corresponding anti-rotation pin were also found to be worn. The four locating pins for the runner were found to be slightly flatted on the bottom from potential contact with the runner. The corresponding groove in the runner showed wear from contact with the locating pins. No degraded seal components were discovered with the No. 2 and 3 seals although some missing pieces of the No. 1 runner o-ring where found therein.

A review of the evidence indicates that the No. 1 runner o-ring was pinched and/or rolled on the runner during installation. The inherent design of the seal precludes verification of proper runner o-ring orientation after installation.

The investigation also determined the existence of insufficient mating surfaces, from previous shaft shoulder stoning, between the No. 1 seal runner landing and the RCP shaft shoulder. Insufficient mating surfaces caused a condition where an acceptable amount of runner nutation (rotate in a wobbling motion) could cause damage to the RCP shaft shoulder. This damage then exacerbated the existing seal runner nutation which led to eventual failure of both the DDCS and runner o-rings. Damage to either the DDCS or runner o-rings would cause excessive No. 1 seal leak-off flow rate.

ANALYSIS OF SAFETY SIGNIFICANCE

Erratic 3A RCP No. 1 seal leak-off flow rates were noted during the evening of February 17, 2013. When No. 1 seal leak-off flow exceeded 5.5 gpm early on February 18, 2013, Operations personnel began a fast load reduction in accordance with plant procedures. When No. 1 seal leak-off flow reached 6.0 gpm, operators manually tripped the reactor and stopped the 3A RCP in accordance with plant procedures, and isolated seal leak-off flow. These actions precluded further 3A RCP No. 1 seal degradation. Recovery from the reactor trip was as expected. As a result, the safety significance of this event is very low.

CORRECTIVE ACTIONS

Corrective actions are documented in AR 1849104 and include the following:

1. The 3A RCP seal was replaced with a new seal.
2. Seal leak-off performance was reviewed for the other five RCPs. Only the Unit 4 4B RCP No. 1 seal showed similar characteristics. It has been repaired (Unit 4 was shut down for a refueling/modification outage at the time) utilizing the lessons learned from the 3A RCP seal investigation.
3. Revise procedure 0-CMM-041.06, Reactor Coolant Pump Coupling and Seal Removal, Inspection, and Installation, to provide additional guidance for machining a RCP shaft shoulder.
4. The seal vendor will perform a technical review of procedure 0-CMM-041.06 to identify any additional needed guidance for seal reassembly that should be incorporated.

LICENSEE EVENT REPORT (LER)
CONTINUATION SHEET

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FAILED COMPONENTS IDENTIFIED: Areva Model 93 Reactor Coolant Pump Seal

PREVIOUS SIMILAR EVENTS:

RCP shaft shoulder anomalies and a pinched No. 1 seal runner o-ring were identified as causes for RCP high No. 1 seal leak-off a few times over the years. The most recent events delayed start-up or resulted in controlled plant shutdown that did not require submission of Licensee Event Reports (LER).

A previous seal failure on the Unit 4 4A RCP (May 5, 2011) was caused by a pinched runner o-ring during installation that led to a failure and high leak-off after only 9 days of operation during startup from a refueling outage. Because the o-ring was found pinched at the upper end of the No. 1 runner o-ring groove, it was concluded that it was caught and moved out of position while lowering onto the shaft. There are several shaft landings where it could make contact and move outside of the groove. Corrective actions included hold points and inspections during installation. However, the installation of the No. 1 runner on the last several inches of the RCP shaft becomes a "blind" installation due to the tolerances between the outer shaft diameter and inner runner diameter clearances. The rolling or twisting of the o-ring in the event described in this LER is more indicative of a lack of lubrication at a certain section of the o-ring. As such, most of the o-ring will slide along the shaft sleeve where it lands or mates. The piece of o-ring that is not lubricated will subsequently roll rather than slide with the rest of the o-ring. Therefore, the prior corrective action would not have prevented recurrence.